

This Sounds Like a Problem to Me

DO THESE ON A SHEET OF BINDER PAPER... DRAW PICTURES!!

1. How are velocity, wavelength, and frequency related? Use units to justify and prove your response.
2. Based your on experience, how is a wave's velocity affected by the tension in the spring? For a constant wavelength, how is the frequency of standing waves affected by increased spring tension?
3. The speed of sound in water is 1440 m/s and in steel it is 5000 m/s. How long would it take for a sound to be transmitted through 2.0 m of steel followed by 10.0 m of water?
4. You have a 0.40 meter long tube that is open at both ends. What tuning fork would resonate at the fundamental with this tube? What tuning fork would resonate at the 2nd harmonic?
5. How long a closed end tube would you need to resonate at the 2nd harmonic with a 256 hz tuning fork?
6. Give physical arguments to account for the boundary conditions at the ends of a guitar string and at the ends of closed and open tubes.
7. The speed of sound in air is 330 m/s at 0 degrees Celsius and 343 m/s at 20 degrees Celsius. What is the speed of sound 77K, the temperature of liquid nitrogen? What is the speed of sound in a pizza oven at 500 degrees Fahrenheit? Degrees Celsius = $(5/9)(F - 32)$
8. When you set up standing waves on your spring in the lab, you might have noticed that as the number of waves present on the string increased, the height of the waves (this is called the amplitude) decreased. Why do you think this was true? What would the effect be on the oscillating spring system if the amplitude did not decrease as observed?
9. The velocity of a wave on a string or spring is proportional to the square root of the tension in the string and to the inverse square root of the mass per unit length of the string.
 - a. Write the velocity as a single function of the variables indicated above.
 - b. Look at the arrangement of the variables in your function. Is the arrangement of the variables consistent with what you know to be true of strings, springs, and musical instruments? In what ways is it consistent?
 - c. If you double the tension in a string, what effect specific does that have on the wave velocity? On the frequency?